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10/629,093	07/28/2003	Robert J. Royer	42P16418	6380

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EXAMINER

CHOE, YONG J

ART UNIT	PAPER NUMBER
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2185

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/05/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/629,093

Applicant(s)

ROYER, ROBERT J.

Examiner

Yong Choe

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 July 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-27 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 July 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>03/24/2005</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. The instant application having Application No. 10/629093 has a total of 27 claims pending in the application. There are 8 independent claims (e.g., claim 1,8,10,12,13,20,22 and 25) and 19 dependent claims, all of which are ready for examination by the examiner.

Priority

2. As required by M.P.E.P. 201.14(c), acknowledgment is made of applicant's claim for priority based on an application filed on 07/28/2003.

Information Disclosure Statement

3. As required by M.P.E.P. 609 (C), the applicant's submission of the information Disclosure Statement dated 03/04/2005 is acknowledged by the examiner and the cited references have been considered in the examination of the claims now pending. As required by M.P.E.P. 609 C(2), a copy of the PTOL-1449 initialed and dated by the examiner is attached to the instant office action.

Oath/Declaration

4. The applicant's oath/declaration has been reviewed by the examiner and is found to conform to the requirements prescribed in 37 C.F.R. 1.63.

Drawings

5. **Figure 5** is objected to because of the following informalities:

The question blocks 500, 520 and 550 in Fig. 5 do not have a "no" direction indicator while they do have a "yes" direction indicator.

Appropriate correction is required.

Specification

6. The disclosure is objected to because of the following informalities:

The specification is objected to as failing to comply with 37 CFR 1.77 (b) because the specification did not include the BRIEF SUMMARY OF THE INVENTION.

Appropriate correction is required.

Claim Objections

7. **Claims 13-21 and 25-27** are objected to because of the following informalities:

Claims 13-21 and 25-27 are objected to under 37 CFR 1.75(c) as being in improper form because a multiple dependent claim cannot depend from any other multiple dependent claim. See MPEP § 608.01 (n). Accordingly, the claims 18-27 and 20 have not been further treated on the merits. Appropriate correction or clarification is required.

Appropriate correction is required.

Claim Rejections - 35 USC § 101

8. **Claims 13-21 and 25-27** are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. Specifically these claims are directed to a program instructions in an inappropriate media/machine-readable medium.

In paragraph [0029], lines 21-27, the applicant's disclosure states that the invention comprises "Moreover, embodiments of the claimed subject matter may also be downloaded as a computer program product, wherein the program may be transferred from a remote computer to a requesting computer by way of data signals embodied in a carrier wave or other propagation medium via a communication link (e.g., a modem or network connection).".

According to the new interim guidelines for determining patent eligible subject matter, a carrier wave is not a tangible media/machine-readable medium.

In order to overcome the rejection for these claims with respect to statutory subject matter under 35 U.S.C. 101, the applicant will have to amend the specification without adding new matter.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. **Claims 1, 5, 6, 13, 17, 18, 22-24 and 25-27** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Liao et al. (US Publication No.: US 2002/0062424)** in view of **Thelin et al. (US Patent No.: US 6,961,814)**.

Regarding independent claims 1, 13, 22 and 25, Liao et al. discloses a method in a Constant Access Time Bounded (CATB) cache, comprising:

reserving a first number of unallocated lines in the cache for pinned data (i.e., locked cache), the first number being less than the number of lines in the cache; and if data needs to be inserted into the cache as pinned data (i.e., locked cache) ([0018] and [0022]).

Liao et al. further teaches initializing a search group of the CATB cache with a capability to dynamically insert and delete elements ([0020]).

However, Liao et al. does not specifically teach selecting a line from the lines reserved for pinned data; storing the data in the line; and inserting the line into a search group of the CATB cache.

Thelin et al. teaches selecting a line from the lines reserved for pinned data (Fig. 2B: Free Links); storing the data in the line; and inserting the line into a search group of the CATB cache (Fig.8 and col.6, lines 17-29: updating linked lists reads on this limitation).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate selecting a replacement line from a reserve of cache

lines and inserting the replacement line into the search group as taught by Thelin et al. into the management of on-chip cache of Liao et al. in order to expedite the allocation process for a host command (col.1, lines 42-43).

Therefore, it would have been obvious to combine selecting a replacement line from a reserve of cache lines and inserting the replacement line into the search group as taught by Thelin et al. with the management of on-chip cache of Liao et al. to obtain the invention.

Regarding claims 5 and 17, Liao et al. teaches wherein inserting the line into a search group of the cache further comprises: indicating that the line is allocated; indicating that the line is pinned; and using a tag of the line to map the line to a search group of the cache ([0020]).

Regarding claims 6 and 18, Liao teaches the CATB cache is implemented as a set-associative cache; each search group of the cache is a set of the cache; and inserting the line into a search group of the cache further comprises: using the address of the data as the tag of the line; performing a modulus operation between the tag and the number of sets (N) in the cache (the tag MOD N) to map the tag to a set of the cache; performing a search based on the tag of the line; and inserting the line into a dynamic data structure that represents the set ([0035]).

Regarding claims 23 and 26, Thelin et al. teaches receiving a first identifier for an element; using the first identifier to compute a second identifier for a search group in

the CATB cache; and traversing the search group to locate an element matching the first identifier (col.2, lines 14-35).

Regarding claims 24 and 27, Thelin et al. teaches wherein the search group is implemented as a linked list (col.1, lines 64-67 and col.2, lines 1-3).

11. **Claims 2 and 14** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Liao et al. (US Publication No.: US 2002/0062424)** in view of **Thelin et al. (US Patent No.: US 6,961,814)** and in further view of **Norman (US Patent No.: US 6,292,868)**.

Regarding claims 2 and 14, Liao et al. and Rowlands do not specifically teach wherein each line of the cache is stored in non-volatile memory.

However, Norman teaches wherein each line of the cache is stored in non-volatile memory (col.6, lines 15-17).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate each line of the cache is stored in non-volatile memory as taught by Norman into the management of on-chip cache of Liao et al. as modified by Thelin et al. in order to increase speed and reliability (col.6, lines 14-16).

Therefore, it would have been obvious to combine each line of the cache is stored in non-volatile memory as taught by Norman with the management of on-chip cache of Liao et al. as modified by Thelin et al. to obtain the invention.

12. **Claims 3, 4, 15 and 16** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Liao et al. (US Publication No.: US 2002/0062424)** in view of **Thelin et al. (US Patent No.: US 6,961,814)** and in further view of **Norman (US Patent No.: US 6,292,868)** and **Wong (US Patent No.: US 7,130,979)**.

Regarding claims 3 and 15, Wong Liao et al., Thelin et al. and Norman do not specifically teach recovering the organization of the cache on power up following a loss of power to the cache by in a first phase of recovery, for each line in the cache determining if the line is allocated; if the line is allocated, inserting the line in a search group of the cache; and if the line is not allocated, inserting the line into a pool of free lines; and in a second phase of recovery, for each search group determining the number of pinned lines in the search group; and adding at least one line from the pool of free lines to each search group that has at least one pinned line.

However, Wong teaches recovering the organization of the cache on power up following a loss of power to the cache by in a first phase of recovery, for each line in the cache determining if the line is allocated; if the line is allocated, inserting the line in a search group of the cache; and if the line is not allocated, inserting the line into a pool of free lines; and in a second phase of recovery, for each search group determining the number of pinned lines in the search group; and adding at least one line from the pool of free lines to each search group that has at least one pinned line (Fig.9, col.9, lines 50-67 and col.10, lines 1-16).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate recovering system as taught by Wong into the management of on-chip cache of Liao et al. as modified by Thelin et al. and Norman in order to ensure that valid volume definition is available even in the event of a power loss (col.4, lines 47-48).

Therefore, it would have been obvious to combine recovering system as taught by Wong with the management of on-chip cache of Liao et al. as modified by Thelin et al. and Norman to obtain the invention.

Regarding claims 4 and 16, Wong teaches wherein the cache is a disk cache in a processor based system (col.1, lines 55-58).

13. **Claims 7 and 19** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Liao et al. (US Publication No.: US 2002/0062424)** in view of **Thelin et al. (US Patent No.: US 6,961,814)** and in further view of **Mandal et al. (US Patent No.: US 6,983,465)**.

Regarding claims 7 and 19, Liao et al. and Thelin et al. do not specifically teach wherein indicating that the line is pinned further comprises modifying metadata associated with the line to indicate that the line is pinned.

However, Mandal et al. teaches wherein indicating that the line is pinned further comprises modifying metadata associated with the line to indicate that the line is pinned (Fig.8 and col.13, lines 36-43).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate managing data caching of Mandal et al. into the management of on-chip cache of Liao et al. as modified by Thelin et al. in order to view and control the system (col.2, line 29).

Therefore, it would have been obvious to combine managing data caching of Mandal et al. with the management of on-chip cache of Liao et al. as modified by Thelin et al. to obtain the invention.

14. **Claims 8, 10, 12 and 20** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Liao et al. (US Publication No.: US 2002/0062424)** in view of **Rowlands (US Patent No.: US 6,748,492)**.

Regarding independent claims 8, 10, 12 and 20, Liao et al. discloses for a whole number N, in an N-way set associative non-volatile disk cache, a method comprising:

reserving a predetermined number of lines for pinned data and organizing them into a pool of lines for pinned data ([0018]); distributing the remaining lines in the cache into N dynamic data structures of approximately the same size to represent the N sets of the cache ([0020]);

Liao et al. does not specifically teach if data is to be inserted into the cache as pinned data, inserting the data into a line from the pool for pinned data; marking the line as allocated by modifying metadata associated with the line; determining the set to which the line belongs using a mapping based on the tag associated with the line; removing the line from the pool for pinned data; and adding the line to the set.

However, Rowlands teaches if data is to be inserted into the cache as pinned data, inserting the data into a line from the pool for pinned data; marking the line as allocated by modifying metadata associated with the line (col.9, lines 42-53); determining the set to which the line belongs using a mapping based on the tag associated with the line; removing the line from the pool for pinned data; and adding the line to the set (col.9, lines 47-52).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the N way set associative as taught by Rowlands into the management of on-chip cache of Liao et al. in order to ensure that a particular entry is used for a particular transaction (col.1, lines 65-66).

Therefore, it would have been obvious to combine incorporate the N way set associative as taught by Rowlands with the management of on-chip cache of Liao et al. to obtain the invention.

15. **Claims 9, 11 and 21** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Liao et al. (US Publication No.: US 2002/0062424)** in view of **Rowlands (US**

Patent No.: US 6,748,492) and in further view of **Wong (US Patent No.: US 7,130,979).**

Regarding claims 9, 11 and 21, Liao et al. and Rowlands do not specifically teach recovering the organization of the cache on power up following a loss of power to the cache by in a first phase of recovery, for each line in the cache determining if the line is allocated; if the line is allocated, inserting the line in a set of the cache using a mapping based on the tag associated with the line; and if the line is not allocated, inserting the line into a pool of unallocated lines; and in a second phase of recovery, for each set in the cache determining the number of pinned lines in the set using the metadata associated with each line in the set; and moving one or more lines from the pool of unallocated lines to each set that has at least one pinned line so that the number of non-pinned lines in each set is approximately the same.

However, Wong teaches recovering the organization of the cache on power up following a loss of power to the cache by in a first phase of recovery, for each line in the cache determining if the line is allocated; if the line is allocated, inserting the line in a set of the cache using a mapping based on the tag associated with the line; and if the line is not allocated, inserting the line into a pool of unallocated lines; and in a second phase of recovery, for each set in the cache determining the number of pinned lines in the set using the metadata associated with each line in the set; and moving one or more lines from the pool of unallocated lines to each set that has at least one pinned line so that

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the number of non-pinned lines in each set is approximately the same (Fig.9, col.9, lines 50-67 and col.10, lines 1-16).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate recovering system as taught by Wong into the management of on-chip cache of Liao et al. as modified by Rowlands in order to ensure that valid volume definition is available even in the event of a power loss (col.4, lines 47-48).

Therefore, it would have been obvious to combine recovering system as taught by Wong with the management of on-chip cache of Liao et al. as modified by Rowlands to obtain the invention.

Citations of Relevant Art

16. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Takahashi et al. (US Patent No.: US 6,434,666) discloses memory control apparatus and method for storing data in a selected cache memory based on whether a group or slot number is odd or even.

Conclusion

17. Claims rejected in the application

Per the instant office action, claims 1-27 have received a first action on the merits and are subject of a first action non-final.

18. Any inquiry concerning this communication should be directed to **Yong Choe** at telephone number **571-270-1053**. The examiner can normally be reached on M-F 8:00am to 5:00pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Sanjiv Shah** can be reached on **571-272-4098**. Any inquiry of a general nature or relating to the status of this application should be directed to the TC 2100 whose telephone number is (571) 272-2100.

YC
Yong J. Choe
Examiner / Art Unit 2185



SANJIV SHAH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100